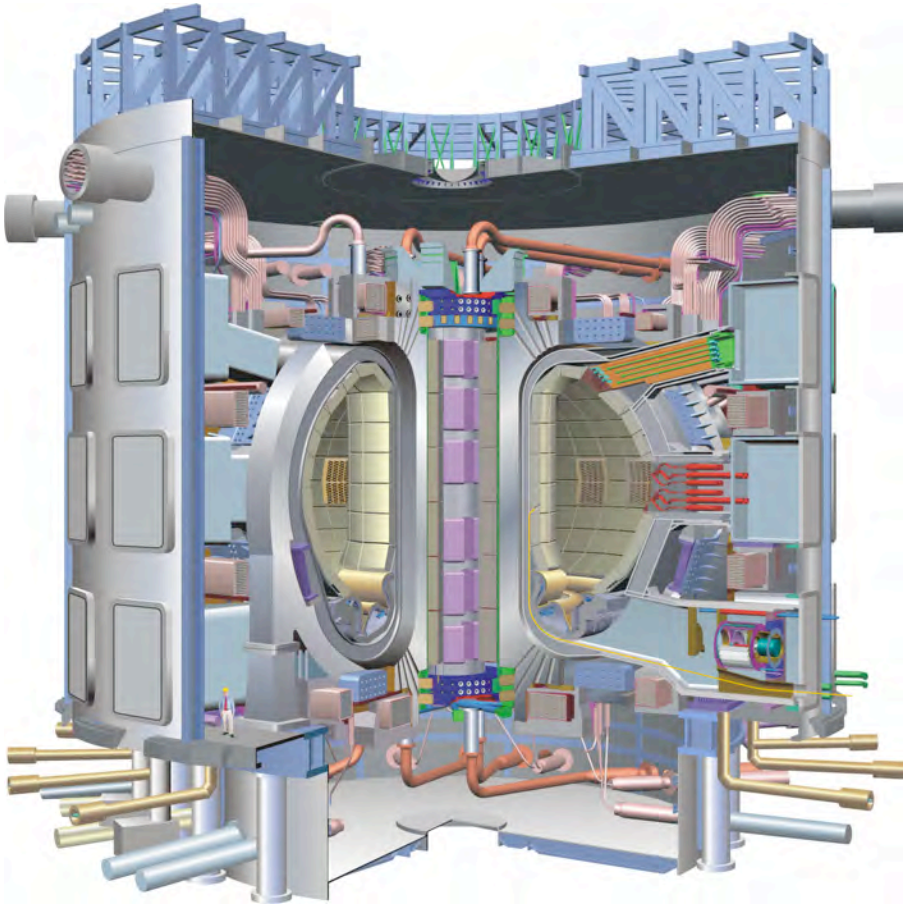
Overview of ITER Project Activities in the U.S.



Ned Sauthoff
Project Manager, U.S. ITER Project Office

FY2008 OFES Budget Planning Meeting
Gaithersburg, MD
March 14, 2006

Evolution of the US budget challenge/constraint

- **In March 2005 in preparation for CD-1, consistent with DOE 413.3, we prepared a draft cost range**

	March 2005 outcome	November 2005
In-kind hardware, ITER staff, and cash	$1.115B - $1.184B - $1.4B	< $1.016B
Central reserve		$0.060B
One-year delay allowance		$0.046B
TOTAL	$1.115B - $1.4B	$1.122B

- **In November 2005, the Director of the Office of Science gave direction on the cost of the US Contributions to ITER project and his vision of management**
  - Fit within a budget cap of $1.122B
  - Include $60M for Central Reserve
  - Include allowance for 1-year delay

- **Dr. Orbach requested that Dan Lehman review the cost estimates for the revised situation**

Process for the N-12 (2005) Revised Procurement Allocations

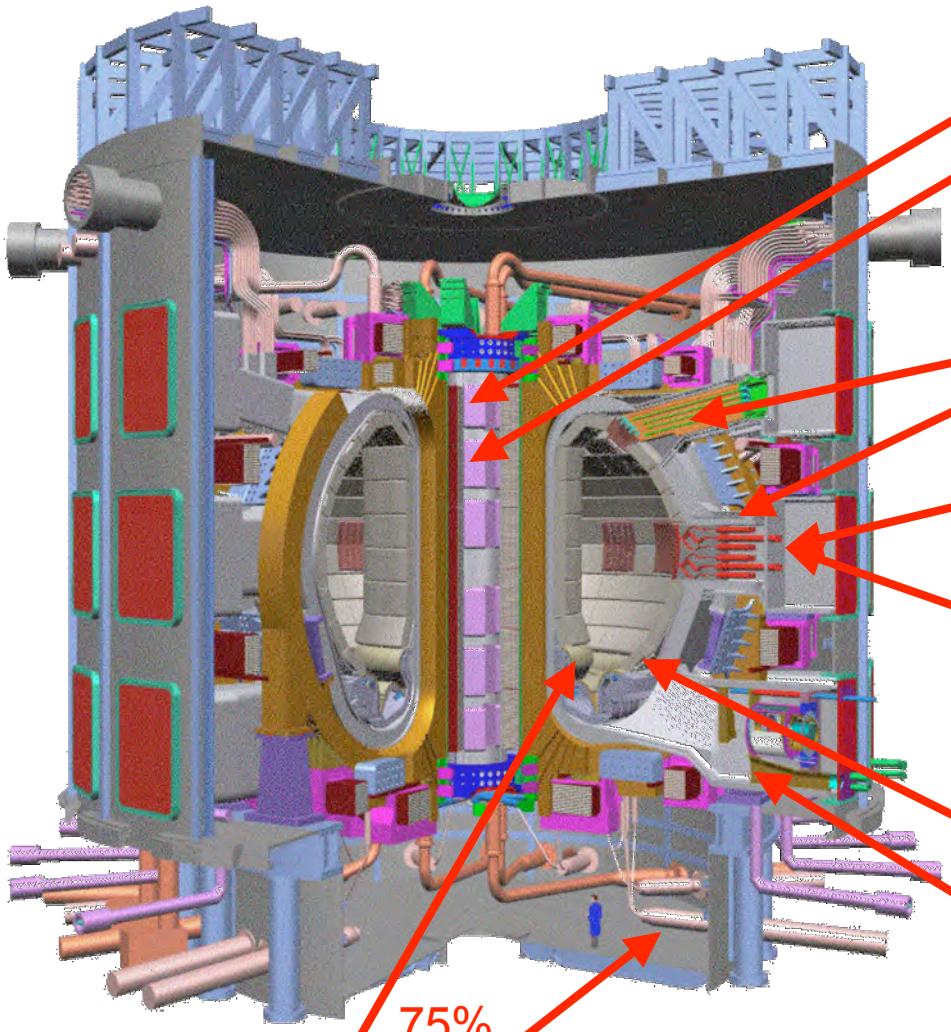
- **The N-11 (October 2005) meeting charged the International Team, working with the Participant Team Leaders, to refine the Procurement Allocations:**
  - To improve the prospects of project success
  - To identify an appropriate procurement allocation for a possible new party

- **Throughout November, IT Leader Yasuo Shimomura identified opportunities for improved allocations and worked with Participant Leaders, reaching agreement before the NSSG-13 meeting**
  - Simplify inter-party interfaces
  - Reduce undesirable multi-party duplication
  - Assign scopes to qualified parties

- **The NSSG-13 procurement allocation working group and the NSSG-13 endorsed the proposed revisions**

- **The N-12 meeting endorsed the proposed revised procurement allocations**

N-12 (2005) Revised U.S. "in-kind contribution" scopes



to JA

4 of 7 Central Solenoid windings

8% of Toroidal Field conductor

15% of port-based diagnostics

to EU

all Ion Cycl. transmission lines,

to IN

to IN

all Elec. Cyclo. Trans. Lines

to IN

Blanket/Shield 20%, limiters

Roughing pumps,
standard components

Tokamak exhaust
processing system

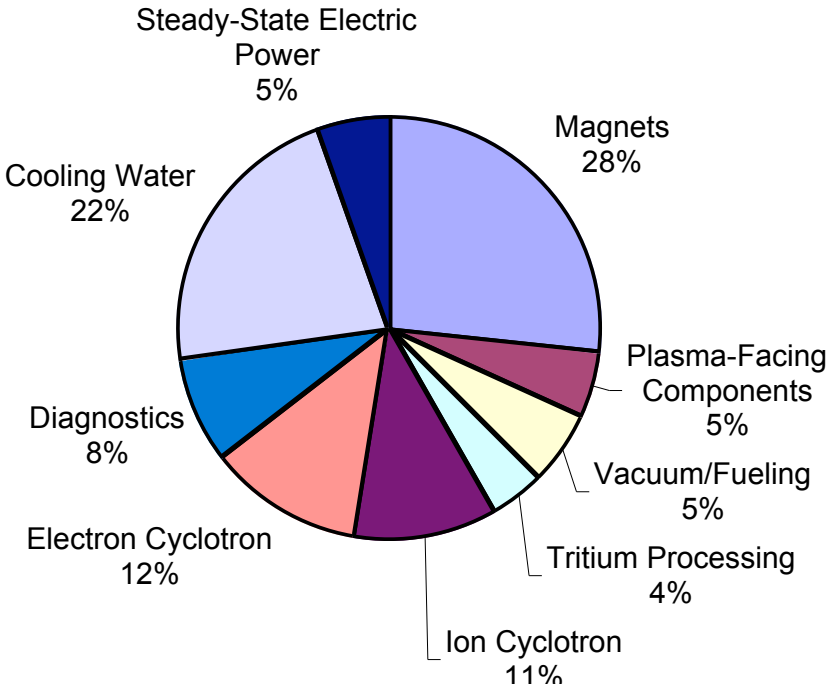
Steady-state
power supplies

75% Cooling for
divertor,
vacuum vessel, …

pellet injector

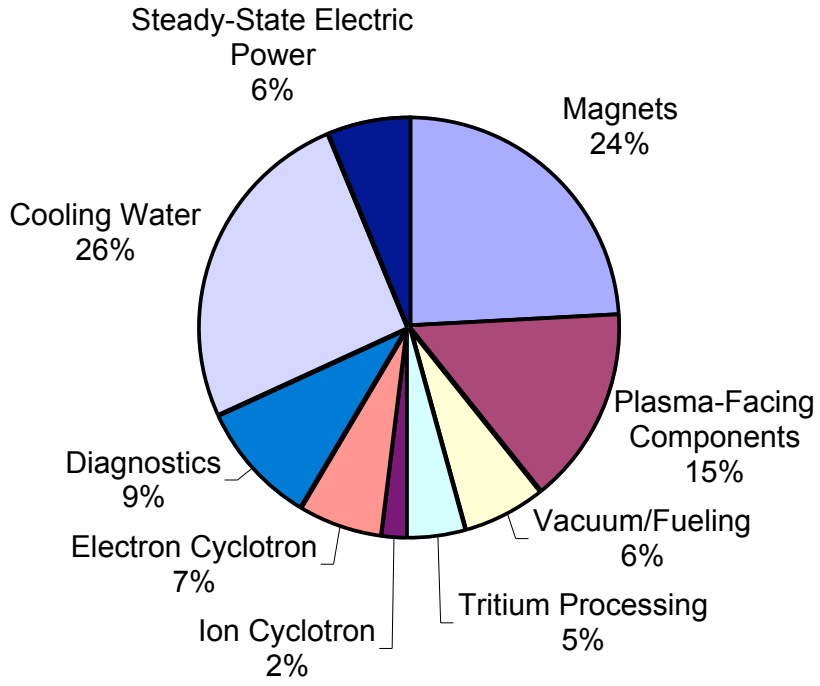
Comparison of N-9 2003 and N-12 2005 US allocations (measured by ITER credit)

N-9 (2003)



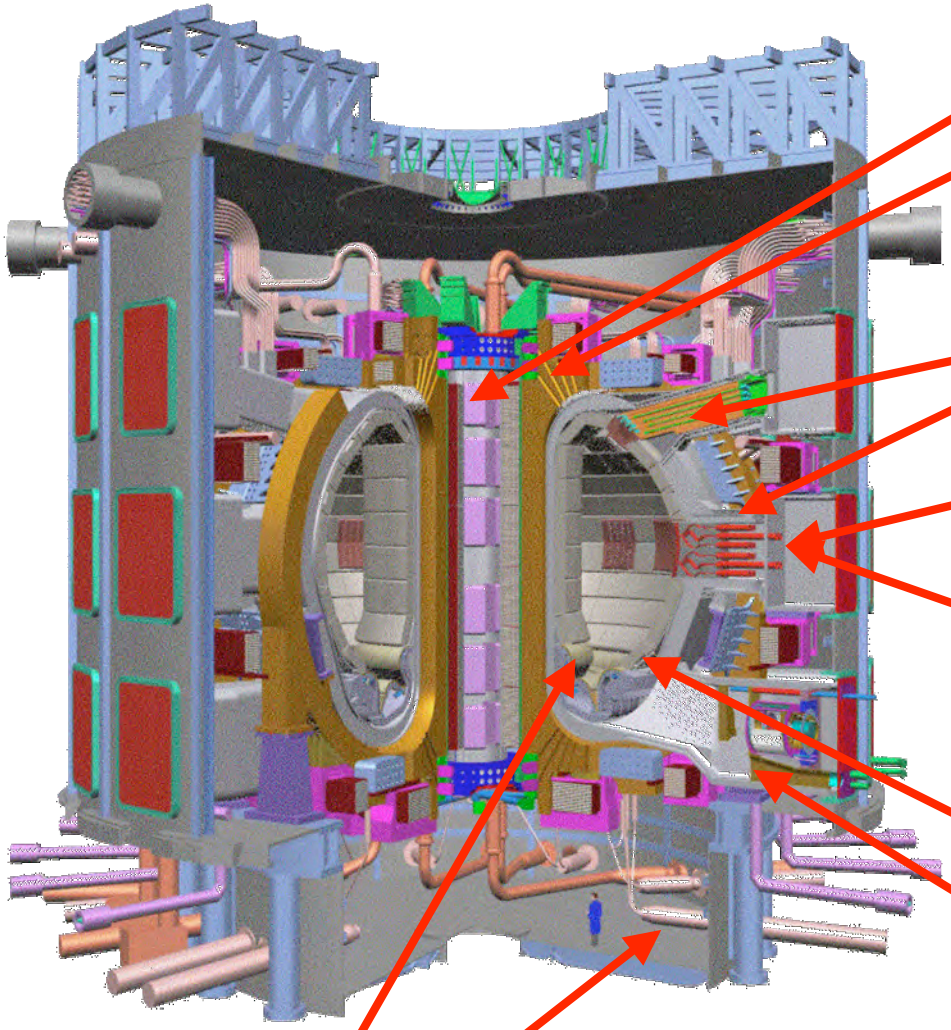
value ~ 270 kIUA

N-12 (2005)



value ~ 248 kIUA

2006 U.S. “in-kind contribution” scopes



7 Central Solenoid windings

8% of Toroidal Field conductor

15% of port-based diagnostics

all Ion Cycl. transmission lines

all Electron Cyclotron Transmission Lines

Blanket/Shield 20%

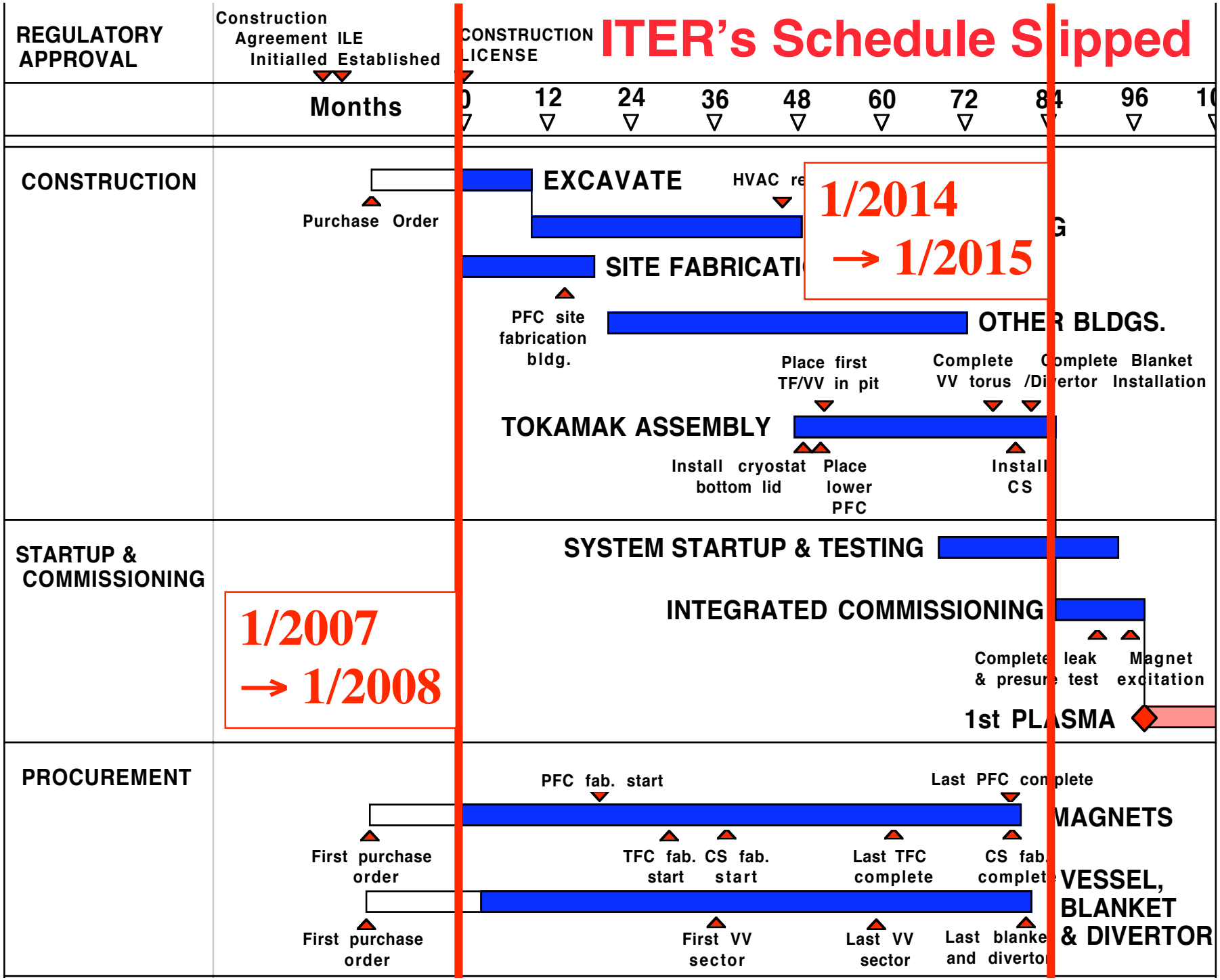
Roughing pumps, standard components

Tokamak exhaust processing system

Steady-state power supplies

75% Cooling for divertor, vacuum vessel, …

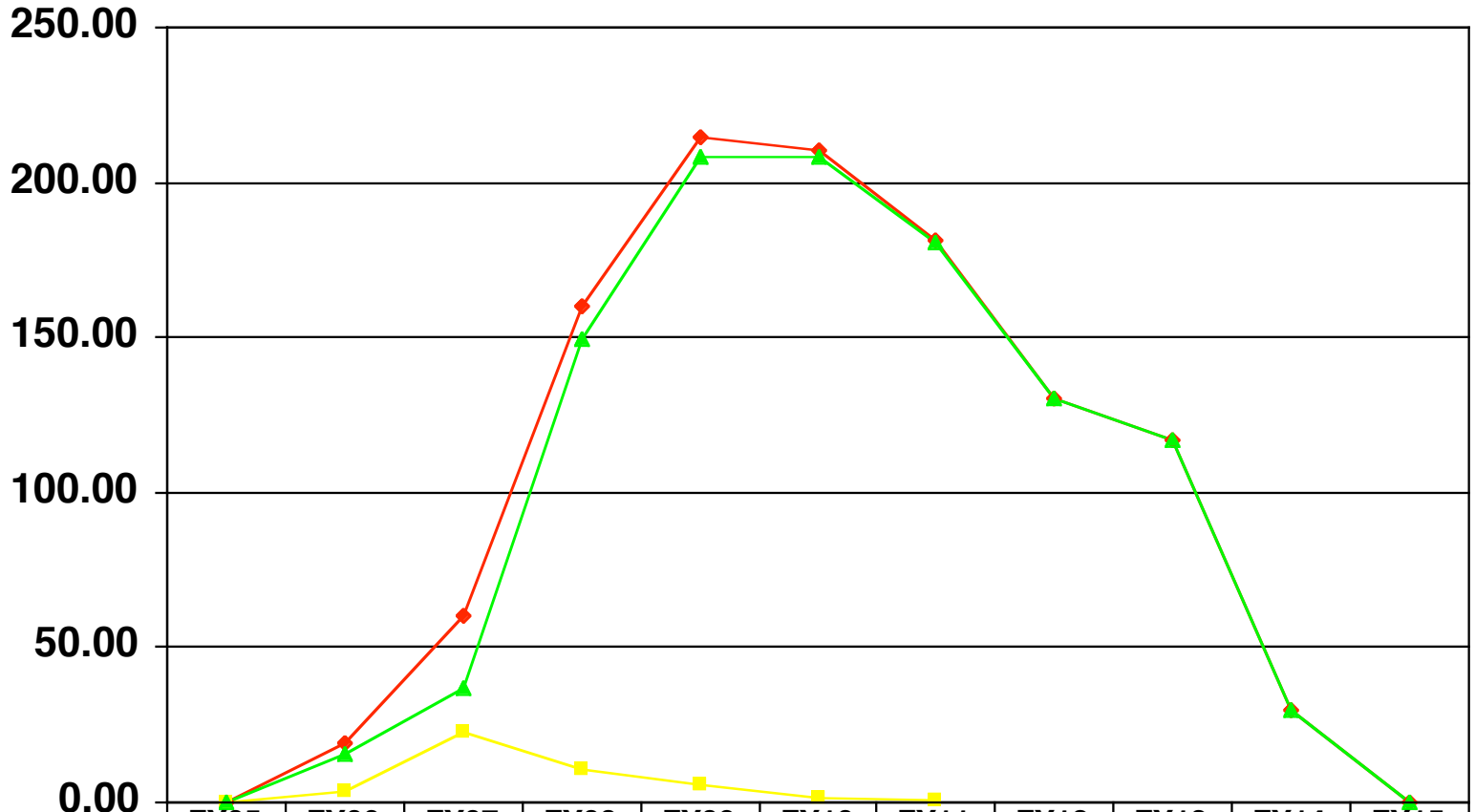
pellet injector


ITER's Schedule Slipped
REGULATORY APPROVAL
Construction Agreement Initialled
ILE Established
CONSTRUCTION LICENSE
Months
0
12
24
36
48
60
72
84
96
CONSTRUCTION
Purchase Order
EXCAVATE
HVAC re
1/2014
→ 1/2015
SITE FABRICATI
PFC site fabrication bldg.
OTHER BLDGS.
Place first TF/VV in pit
Complete VV torus
Complete Blanket /Divertor Installation
TOKAMAK ASSEMBLY
Install cryostat bottom lid
Place lower PFC
Install CS
STARTUP & COMMISSIONING
SYSTEM STARTUP & TESTING
1/2007
→ 1/2008
INTEGRATED COMMISSIONING
Complete leak & pressure test
Magnet excitation
1st PLASMA
PROCUREMENT
PFC fab. start
Last PFC complete
MAGNETS
First purchase order
TFC fab. start
CS fab. start
Last TFC complete
CS fab. complete
VESSEL, BLANKET & DIVERTOR
First purchase order
First VV sector
Last VV sector
Last blanket and divertor

Some key dates for the U.S. ITER Project

Project Office Transition Plan approved	January, 2006
SC Lehman “cost only” review	February, 2006
SC Lehman Review	September, 2006
OECM Cost Review (per Dep Sec @CD0)	November, 2006
OECM endorsement	December, 2006
CD1 - Baseline Development	December, 2006
CD2 - Performance Baseline	December, 2007

US ITER Budget Profile ($M), summing to $1.122B



	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15
Budget request	0.00	19.32	60.00	160.00	214.50	210.00	181.29	130.00	116.90	30.00	0.00
OPC	0.00	3.45	23.00	10.50	6.00	1.50	0.50				
TEC	0.00	15.87	37.00	149.50	208.50	208.50	180.79	130.00	116.90	30.00	0.00

Recent progress on R&D and design

- Emphasizing progress on in-kind hardware contributions through both domestic R&D and design work and through support of the International Team
  (US will be seeking credit in several areas)

- Multi-party discussions will target effective arrangements for shared packages

- Funds for infrastructure investments / test facilities are generally being held centrally, pending further discussions with ITER parties about effective joint arrangements

- Funds for WBS-managers and close-support groups are phase-funded during the transition, pending selections of performers

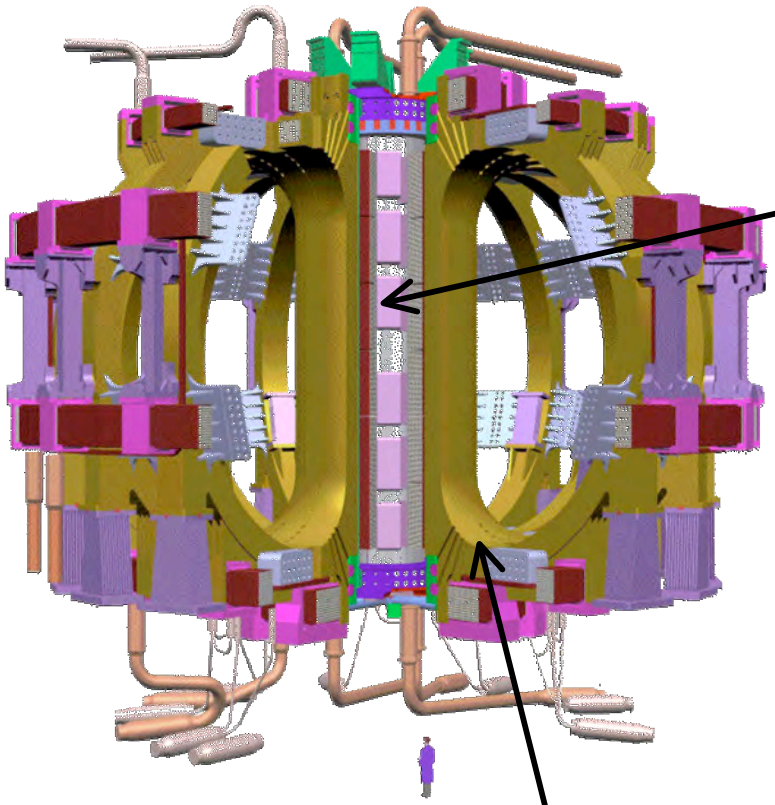
Preparation for the CD-1 reviews

- **Per the Deputy Secretary's approval of CD-0, the CD-1 approval is contingent on a cost review by the Office of Engineering and Construction Management**
  - DOE/SC "Lehman" review: September 2006
  - OECM review: November 2006

- **The US Project will be addressing the issues of cost, schedule, and management in preparation for these reviews**
  - clarifying the roles of the ITER Organization and the Domestic Agencies
  - refining scope, with IT and ITER parties, including effective arrangements
  - acquiring appropriate documentary basis for the cost estimate
  - value engineering
  - project management plan and acquisition strategy
  - …

- **The Project Team must be assembled and engaged throughout these activities**

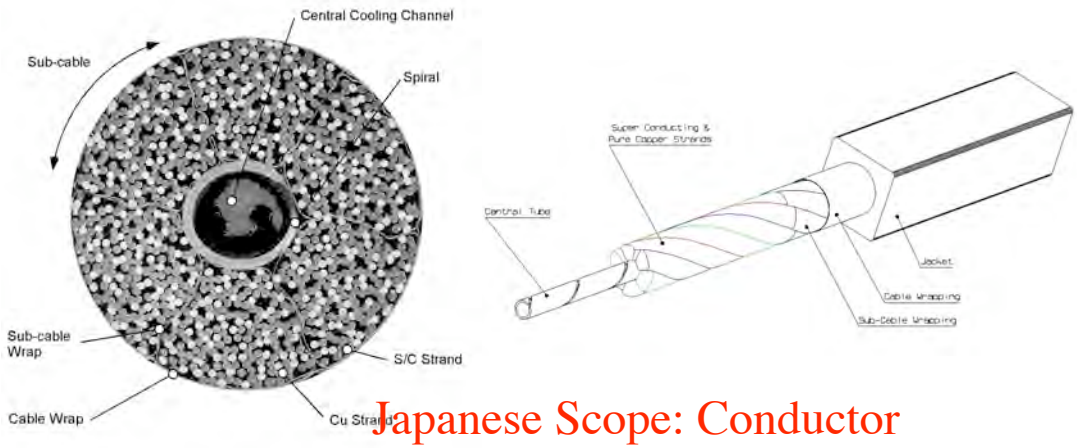
Revised US procurement allocations: Magnet system



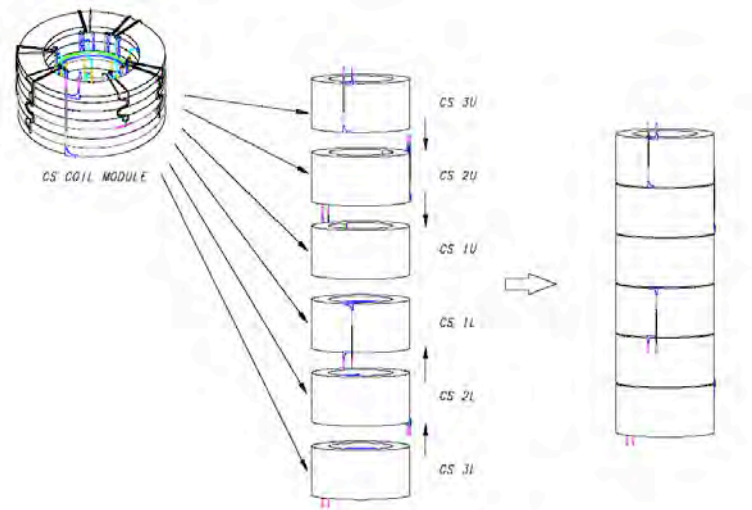
- **2003: US would provide 4 of 7 Central Solenoid modules (conductor, winding, …) while FLEX would provide the other 3 modules**
  - Issues:
    - duplication between parties
    - intricate interface
- **2005: Japan provides all CS conductor and US winds … all 7 modules**
  - Advantages:
    - minimizes duplication
    - simplies interface
    - shifts conductor risks

- **2005: US provides 8% of the TF conductor**
  - engages the US in superconducting materials
  - allows the US to build on multi-party developments

Central Solenoid (CS) Coil



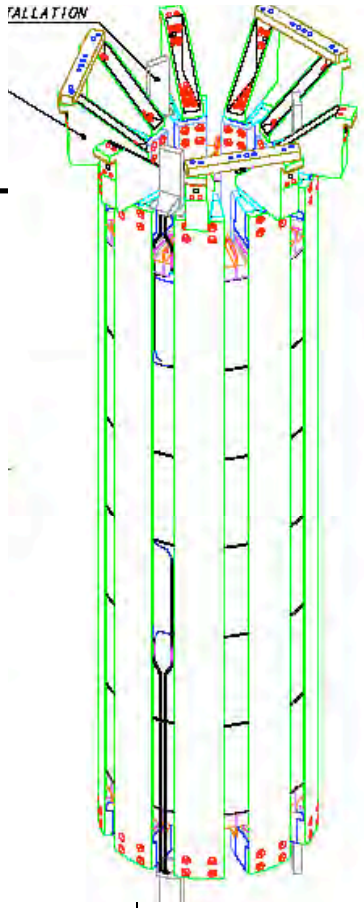
Japanese Scope: Conductor



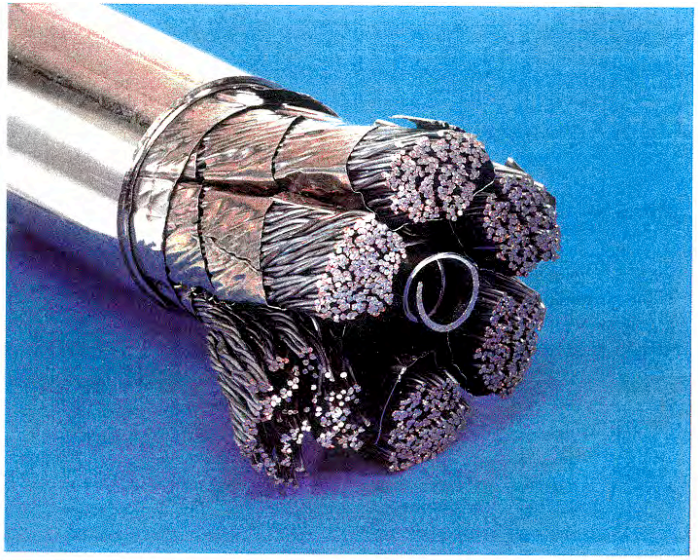
US Scope: Modules

	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	Start manufacturing studies and prepare for procurement of industrial R&D contracts	Refine planning and scope definition/clarification with the ITER International Team (IT) for manufacture of coils; perform preliminary design and analysis.
FY 2007:	Complete all R&D tests.	Complete design, prepare procurement package for coil fabrication.
FY 2008:		Award procurement for coil fabrication.

Central Solenoid (CS) Structure



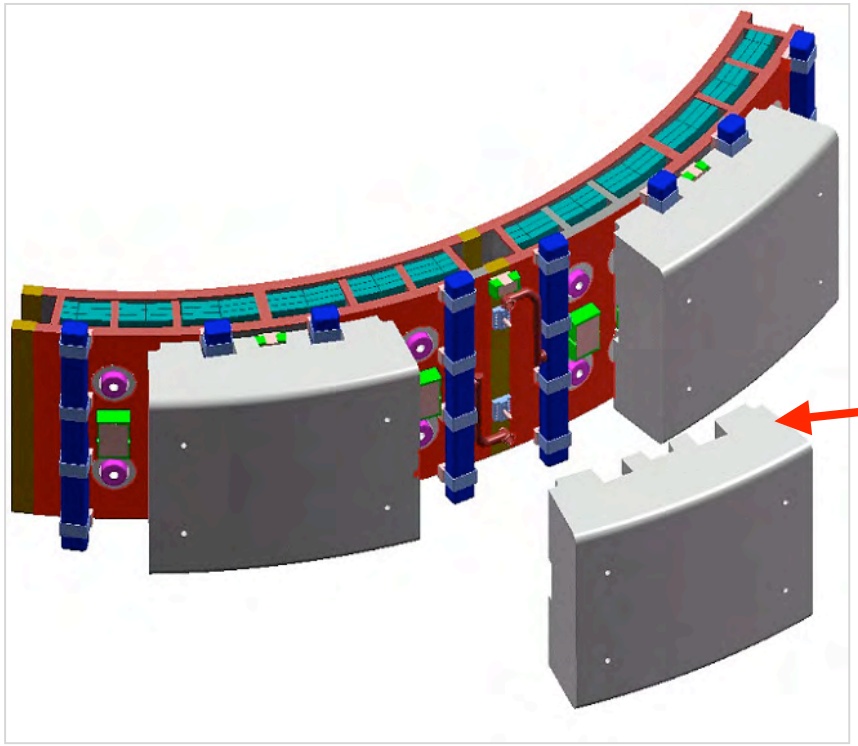
	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	Begin planning based on CS coil design and interfaces with the IT.	Begin planning based on CS coil design and interfaces with the IT.
FY 2007:	Start development of fabrication methods and tests.	Continue planning based on CS coil design and interfaces with the IT.
FY 2008:	Complete R&D.	Continue preliminary design and analysis.

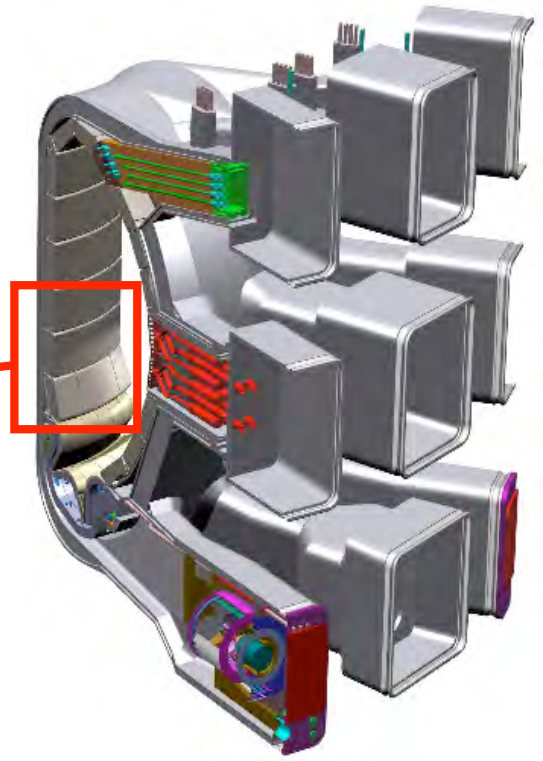


Toroidal Field (TF) Coil Conductor

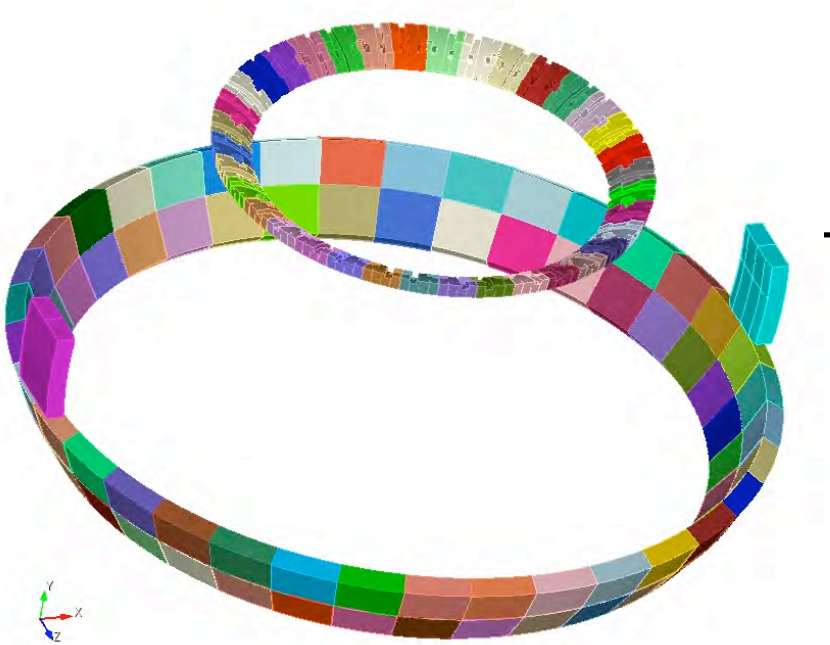
	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	Begin qualification of materials and fabrication tests for the TF coil conductor.	Begin planning and scope definition/clarification with the ITER International Team (IT) and other parties in this scope for manufacture of TF coil conductor.
FY 2007:	Continue qualification of materials and fabrication tests for the TF coil conductor.	Complete design; complete production of strand for prototype pancake.
FY 2008:	Complete R&D on conductor.	Initiate procurement of cabling and jacket material for prototype pancake. Award procurement of strand for TF Coil Conductor.

Revised US procurement allocations: First Wall / Blanket/Shield





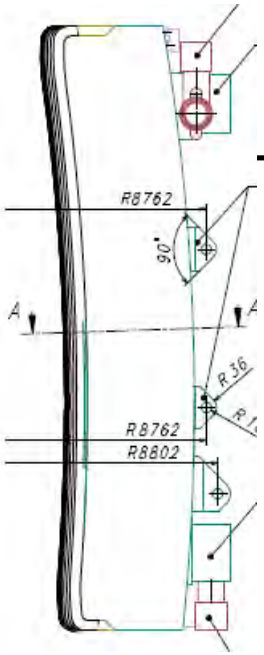
- **2003: US provides 10% of the area of First Wall / Blanket / Shield modules**
  - Issue: significant R&D spread over only small amount of fabrication
- **2005: US provides 20% of the area of First Wall / Blanket / Shield modules**
  - Advantage: Spreads R&D over larger fabrication base

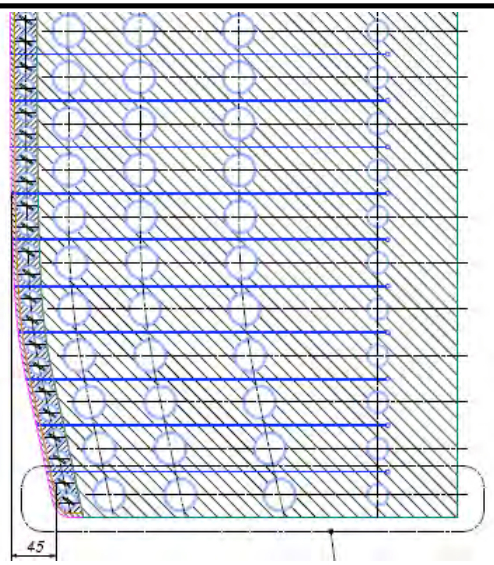


First Wall and Shield Assembly

	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	Begin joining R&D for the first wall components and fabrication R&D for the modules.	Refine planning and scope definition/clarification with the IT; start preliminary design for first wall and shield components as included in the U.S. scope.
FY 2007:	Continue joining R&D for the first wall components and start materials and joining R&D for shield components.	Complete design for first wall and shield as included in U.S. scope.
FY 2008:	Complete all R&D work.	Issue RFPs for first wall and shield components.

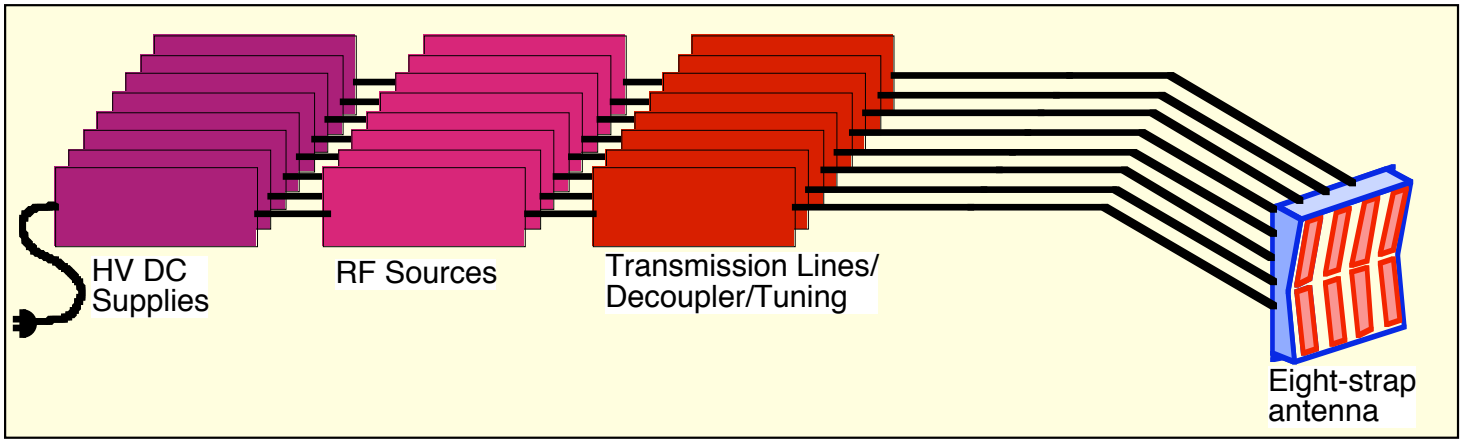
Port Limiter System



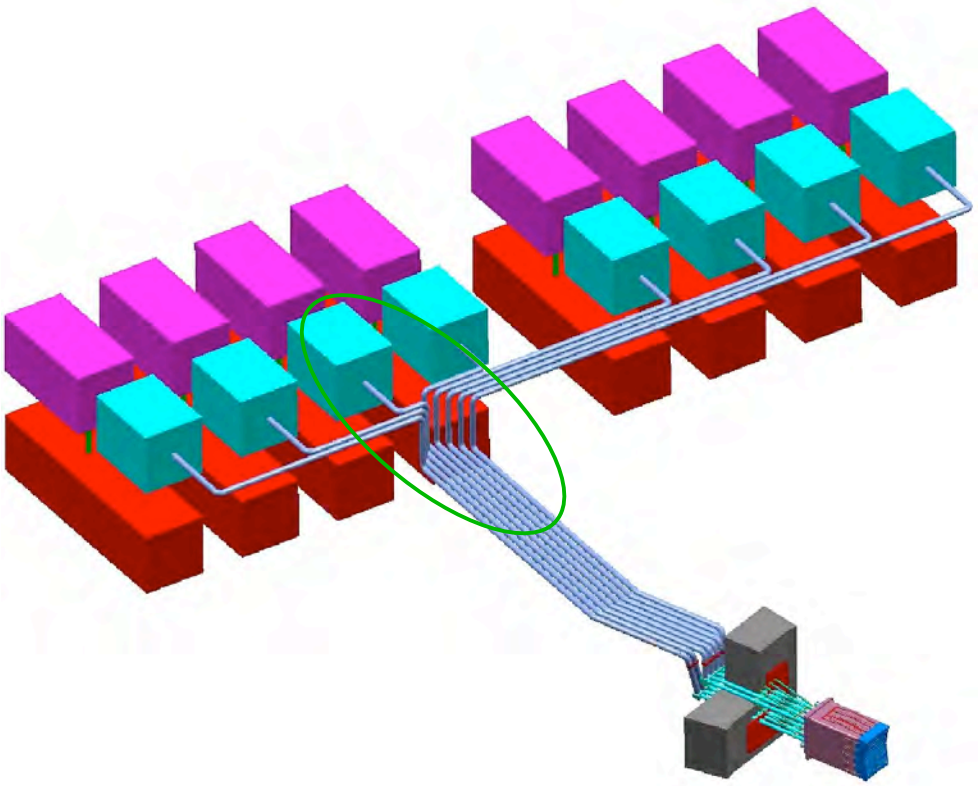


	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	Refine planning and scope definition/clarification with the IT and start concept definition.	Refine planning and scope definition/clarification with the IT; start concept definition.
FY 2007:	Start joining, materials, and actuation R&D for port limiters.	Continue planning scope definition/clarification and concept development.
FY 2008:	Continue joining, materials, and actuation R&D.	Continue planning, concept development, and start preliminary design.

Revised US procurement allocations: Ion Cyclotron Heating and Current Drive System



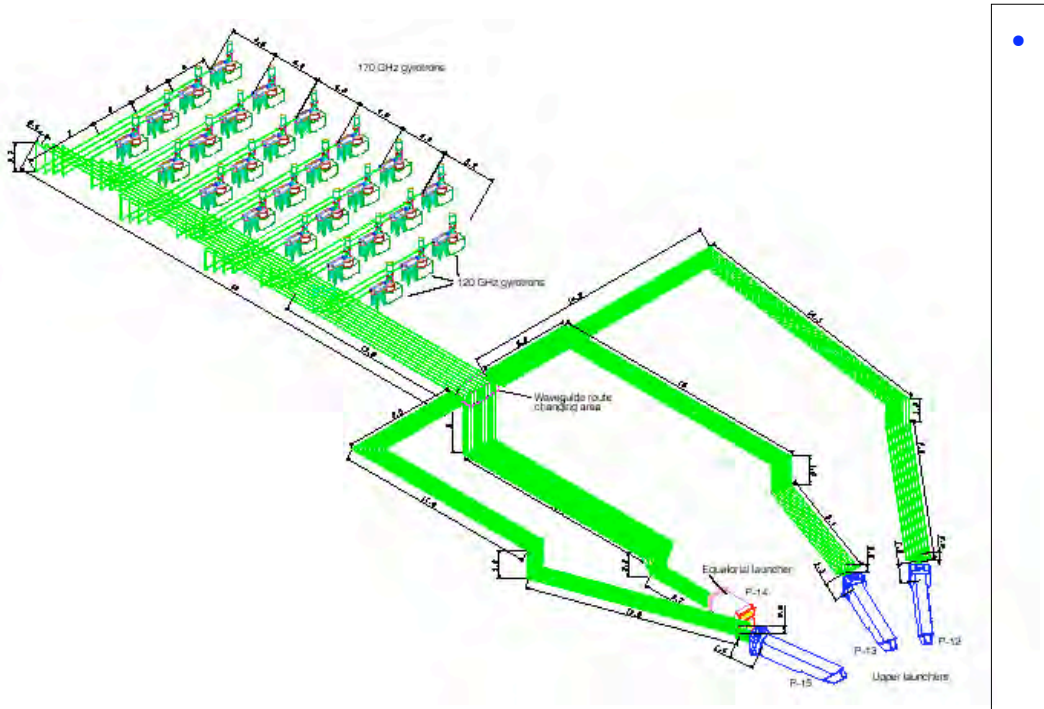
- **2003: US shares antenna with EU and provides all other components**
  - Issues:
    - interface with EU on antenna, with significant R&D
    - opportunity for scope for India
- **2005: US provides transmission lines**
  - Advantages:
    - simplies interfaces
    - provides appropriate scope for India



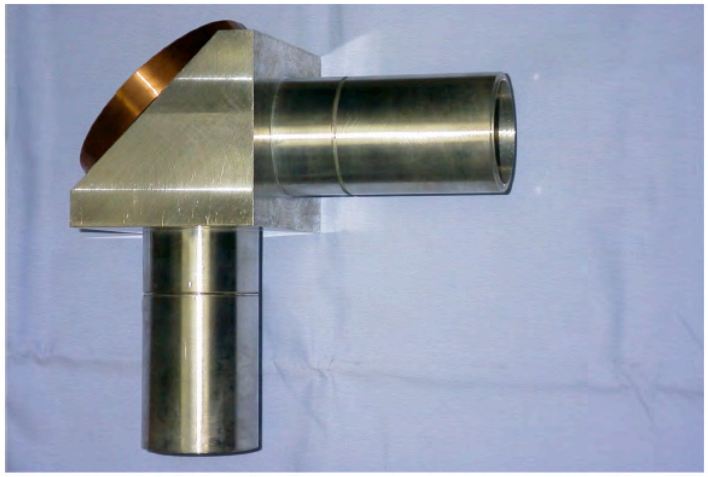
Ion Cyclotron System

	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	Start transfer line R&D.	Refine planning and scope definition/clarification with the IT.
FY 2007:	Continue R&D.	Continue planning and conceptual design.
FY 2008:	Complete R&D program.	Start preliminary design.

Revised US procurement allocations: Electron Cyclotron System Configuration



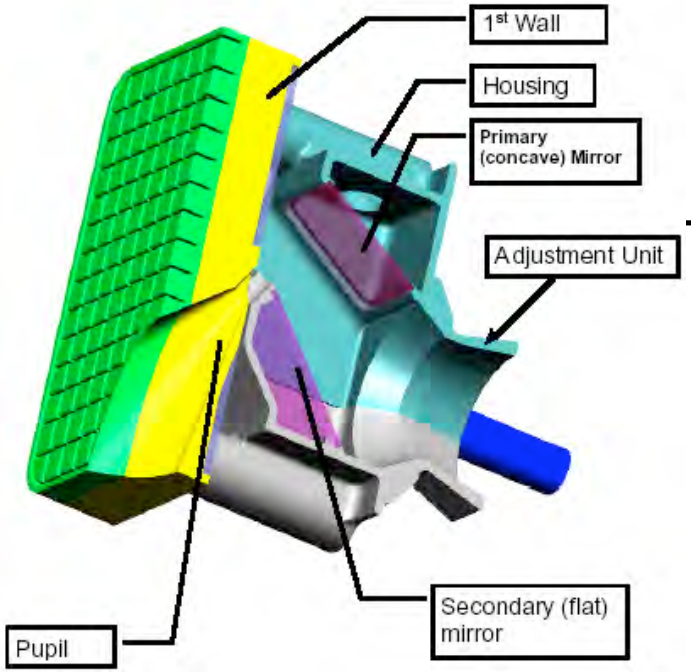
- **2003: US would provide 120GHz startup gyrotrons and all power supplies and transmission lines; others provide 170GHz gyrotrons and launchers**
  - Issues:
    - intricate interface between gyrotron providers and US power supplies
    - possible scopes for India
- **2005: US provides only transmission lines**
  - Advantages:
    - simplifies interfaces
    - provides appropriate scopes for India

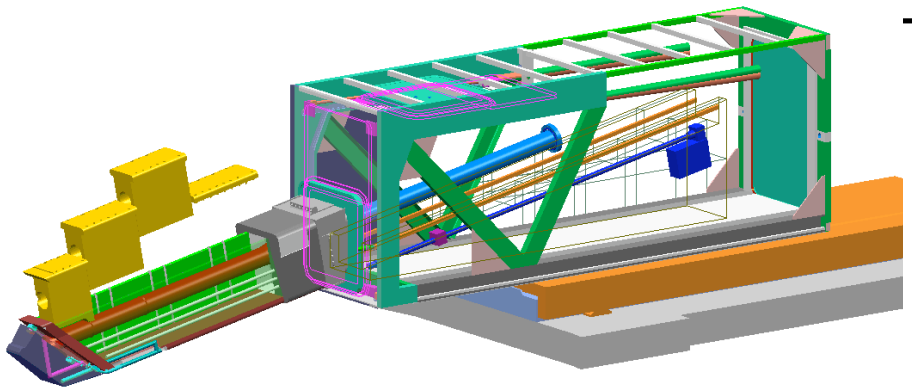


Electron Cyclotron System

	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	Start transfer line R&D.	Begin planning and scope definition/clarification with the IT.
FY 2007:	Continue R&D.	Start preliminary design.
FY 2008:	Continue R&D.	Conduct preliminary design review.

Diagnostics

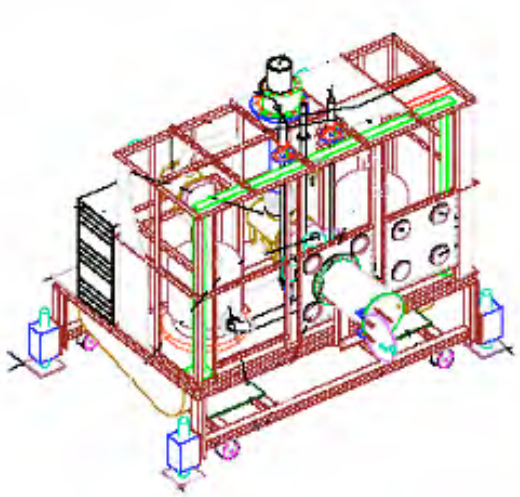


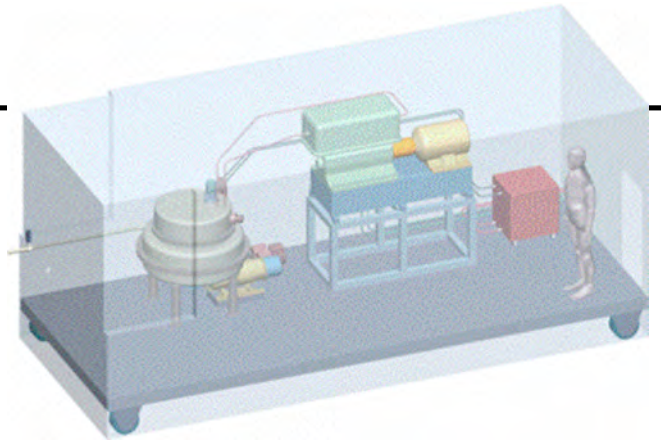


Instrumentation packages and Port Plug packages

	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	Perform assessments of R&D needs and start R&D on most diagnostics.	Award exploratory contracts for diagnostics, evaluate present IT design, begin preliminary design for many systems.
FY 2007:	Complete assessments of R&D needs, continue R&D on most of the diagnostics, and start R&D on remaining diagnostics.	Continue or start preliminary design for most components and systems.
FY 2008:	Continue diagnostics R&D.	Continue preliminary design for most components and systems.

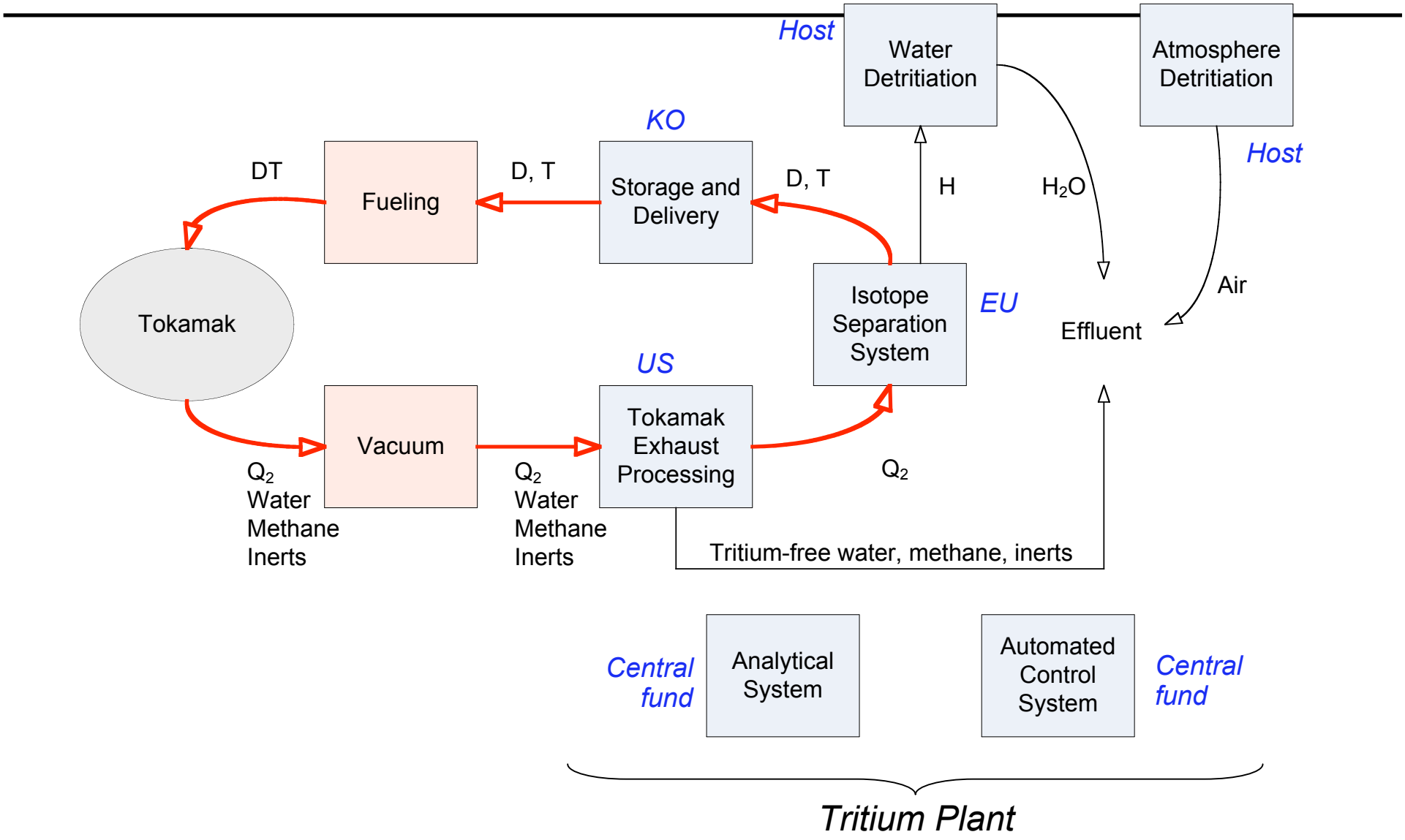
Vacuum Pumping and Fueling Systems



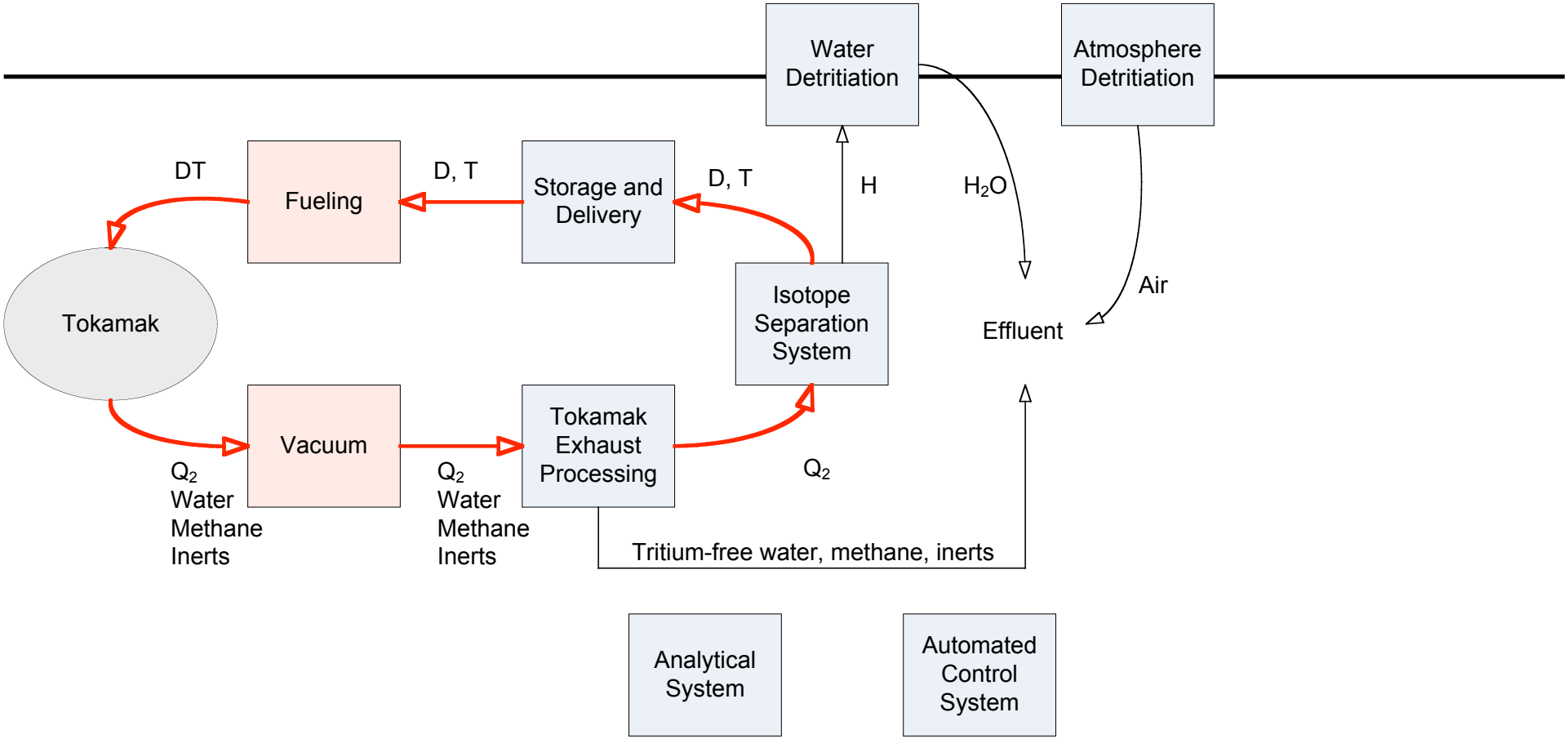


	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	Start R&D on the extruder and rotor prototype.	Begin planning and scope definition/clarification with the IT; begin concept development for the pellet injector.
FY 2007:	Complete R&D on the extruder, continue R&D on the rotor prototype, and begin R&D on guide tube prototype.	Continue concept development for the pellet injector.
FY 2008:	Complete R&D.	Begin planning and scope definition/clarification with the IT for roughing pump sets and change over boxes; complete pellet injector concept development.

The ITER Tritium Plant is essentially a small chemical processing plant consisting of seven systems



Tritium Plant Exhaust Processing System

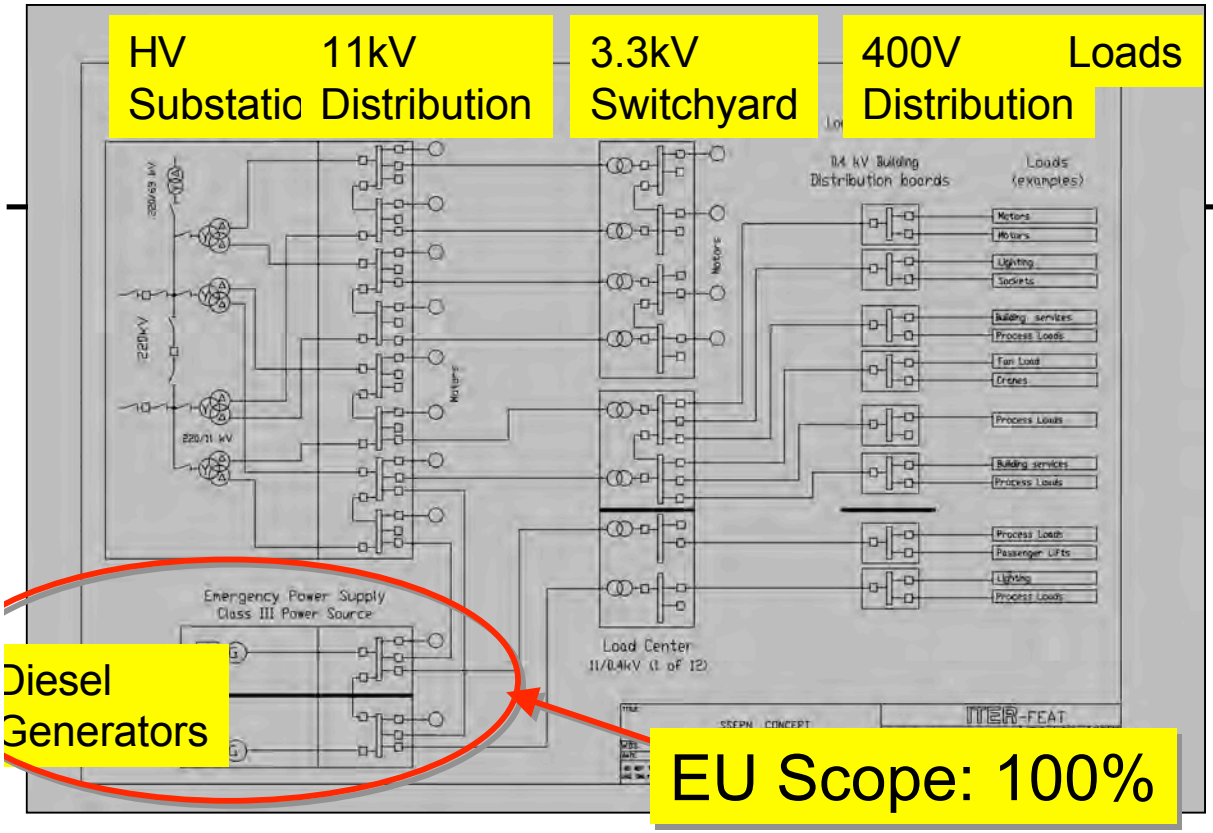


	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	Start tritium plant R&D.	Begin planning and scope definition/clarification with the IT; begin preliminary design.
FY 2007:	Continue tritium plant R&D.	Start final design.
FY 2008:	Continue tritium plant R&D.	Complete design.

Cooling Water Systems

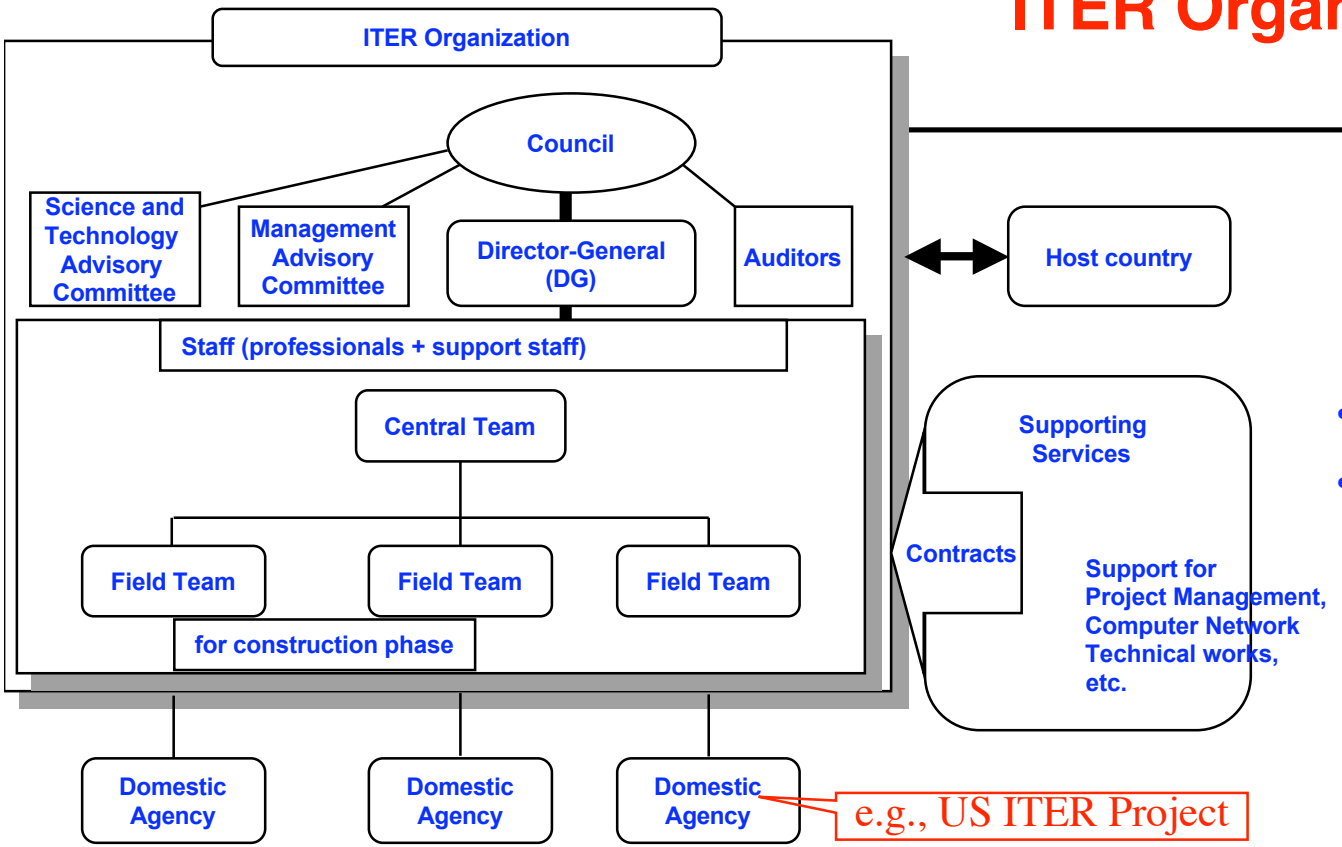
	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	No R&D	Begin planning and scope definition/clarification with the IT; prepare procurement spec for the various cooling water subsystems.
FY 2007:	No R&D	Award procurements to design and provide the components for the various subsystems.
FY 2008:	No R&D	Begin fabrication/procurement of components.

Steady State Electrical Power Network



	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	No R&D	Begin planning and scope definition/clarification with the IT.
FY 2007:	No R&D	Award contract to design, procure, and install components for phase one.
FY 2008:	No R&D	Procure components for phase one.

ITER Organization Support



- **ITER Staff**
- **Cash Fund**

	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	No R&D	Provide secondees and cash as required by the IT.
FY 2007:	No R&D	Provide secondees and cash as required by the IT.
FY 2008:	No R&D	Provide secondees and cash as required by the IT.

Project Support

	Other Project Costs (OPC)	Total Estimated Costs (TEC)
FY 2006:	No R&D	Select performers for positions in the Project Office including WBS Leaders and Engineering Manager, ES&H manager, QA specialist, etc.; begin to hire/assign/or designate staff for Systems Engineering and Design Integration, Project Controls, Information Systems, Communications Physics, and other positions.
FY 2007:	No R&D	Provide status reports and support various one-time and periodic reviews; perform ES&H analyses and studies supporting design of U.S. ITER components; begin CAD translations and development of models for neutronics analysis, EM disruption, analysis, thermal analysis, etc.
FY 2008:	No R&D	Continue as in FY 2007.

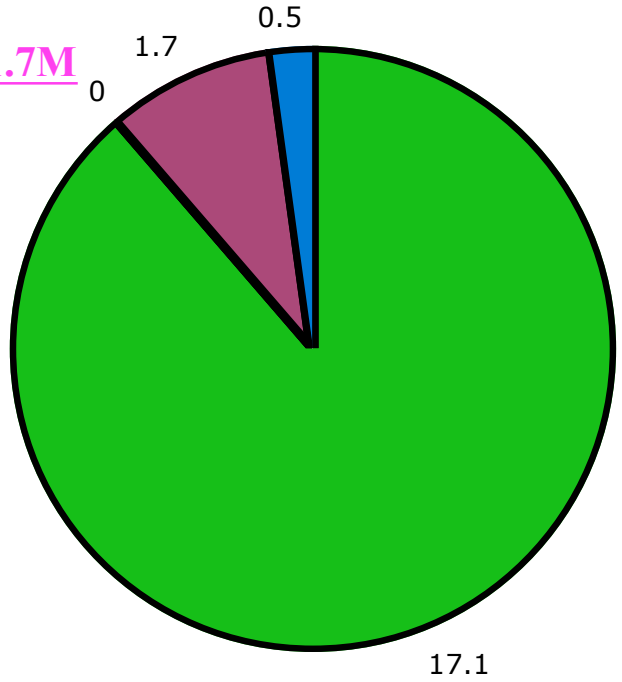
ITER MIE Funding for FY06

Distribution of Funding

Total of $19.3M in FY06

Cash to IO $0.5M

ITER Organization (IO)
Employees and Secondees $1.7M



Design/R&D/Mgmt $17.1M

- Magnet
- First wall shields
- Port Limiters
- Cooling water systems
- Pellet injector
- Exhaust Processing
- ICH transmission line
- ECH transmission line
- Diagnostics
- Project management

ITER MIE Funding for FY07

Distribution of Funding

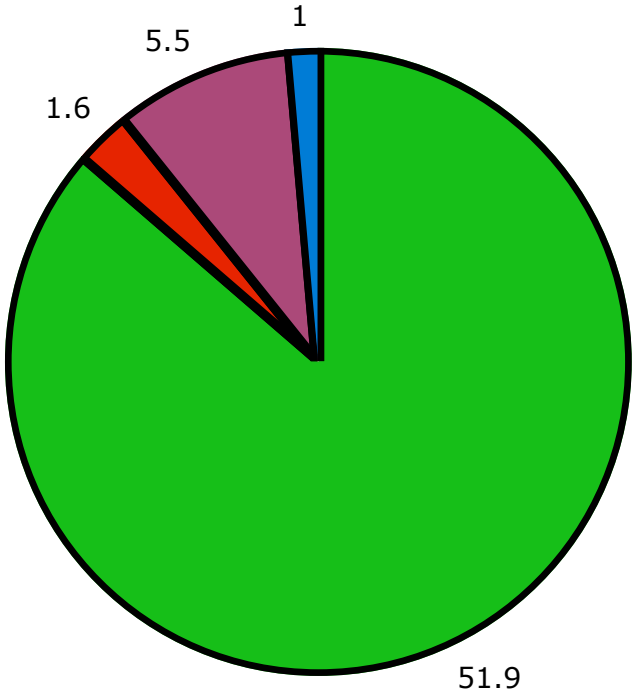
Total of $60.0M in FY07

ITER Organization (IO)
Employees and Secondees $5.5M

Cash to IO $1.0M

Industry Hardware Commitments $1.6M

- Toroidal field coil conductor
- Cooling water components
- Blanket materials



Design/R&D/Mgmt $51.9M

- Magnet
- First wall shields
- Port Limiters
- Cooling water systems
- Pellet injector
- Exhaust Processing
- ICH transmission line
- ECH transmission line
- Diagnostics
- Project management

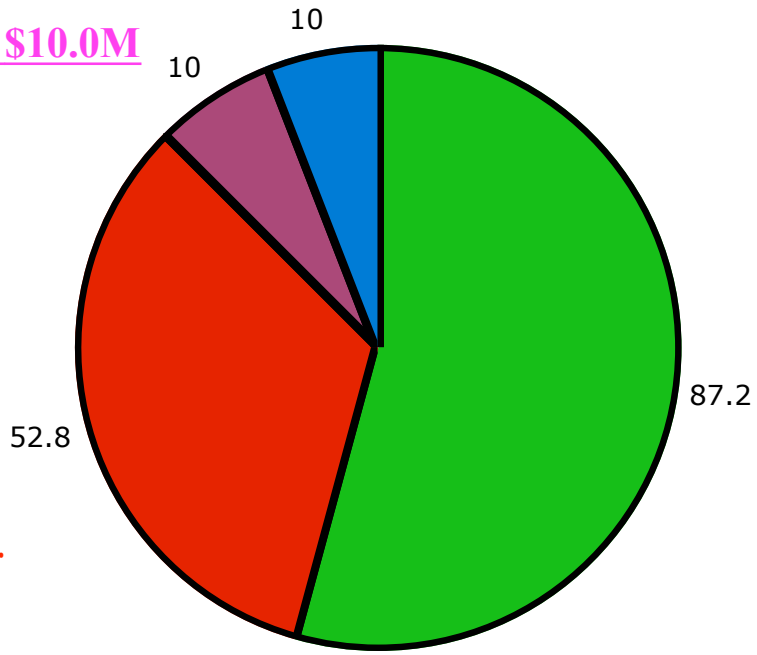
ITER MIE Funding for FY08

Distribution of Funding

Total of $160.0M in FY08

Cash to IO $10.0M

ITER Organization (IO)
Employees and Secondees $10.0M



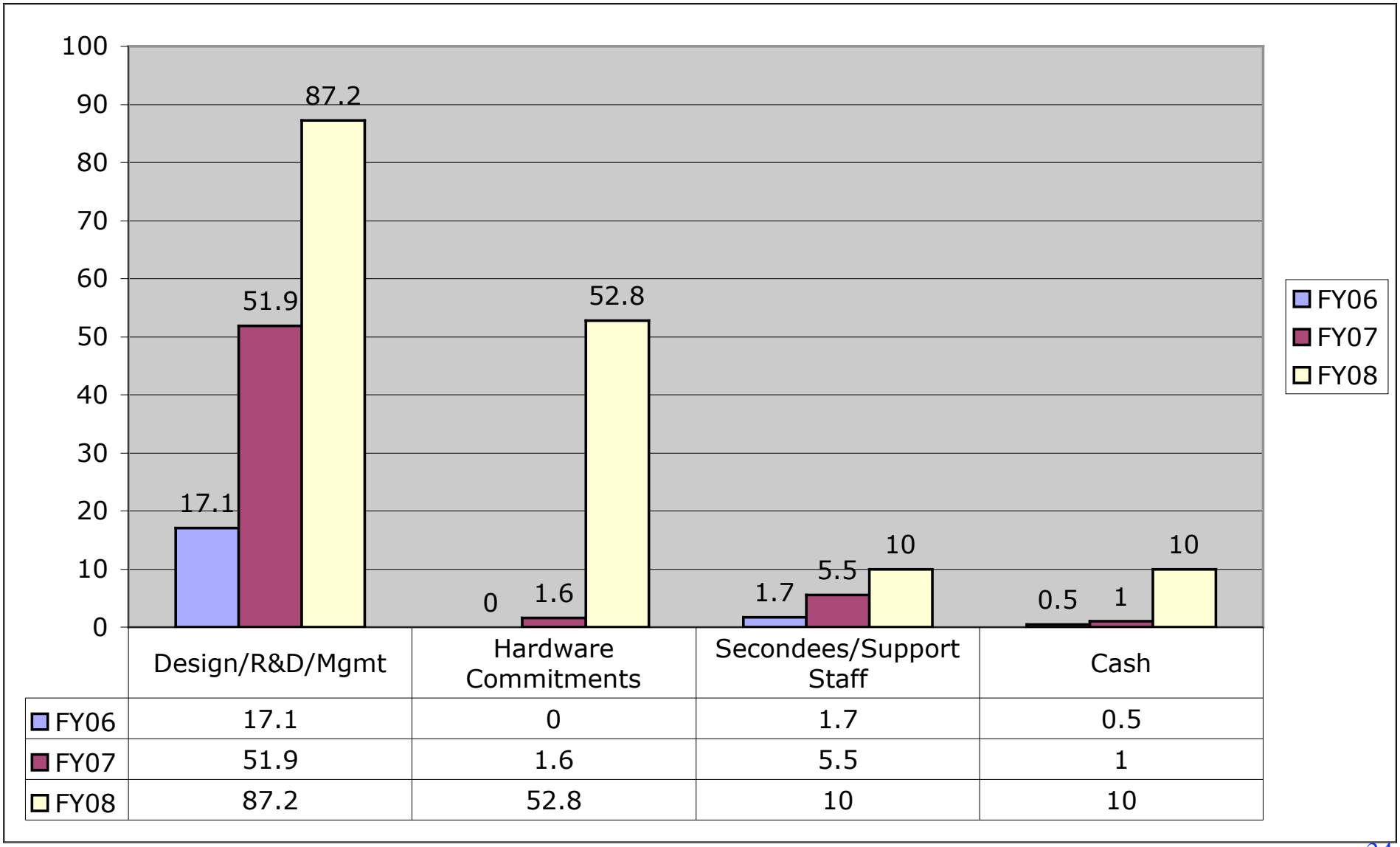
Industry Hardware Commitments $52.8M

- Toroidal field coil conductor
- Blanket materials
- Cooling water components
- Diagnostic components

Design/R&D/Mgmt $87.2M

- Magnet
- First wall shields
- Port Limiters
- Cooling water systems
- Roughing pump
- Pellet injector
- Exhaust processing
- Electrical power systems
- ICS transmission line
- ECH transmission line
- Diagnostics
- Project and procurement mgmt

Summary of Budgets evolution within each area



	Design/R&D/Mgmt	Hardware Commitments	Secondees/Support Staff	Cash
FY06	17.1	0	1.7	0.5
FY07	51.9	1.6	5.5	1
FY08	87.2	52.8	10	10

Institutional Issues

- **Enable and bolster the ITER International Organization**
  - Emphasize its strong system integration role
  - Contribute to effective project management tools, practices and culture
  - Provide ITER staff to enable excellent project management and integration in key technical areas

- **Build the US Domestic Agency team**
  - Emphasize US role as a provider of components, staff and cash
  - Establish the US organization, building on the SNS model, tools and culture
  - Populate the US organization with excellent performers: individuals and institutions (partners and subcontractors)

- **Integrate the International and Domestic teams**
  - Emphasize effective interactions and partnership between teams
  - Establish clear and complementary roles and responsibilities
  - Develop and use effective tools and procedures

Bottom Line…

Highest level arrangements are nearly in place

- Site and Director General selected
- Proposed International Agreement with ITER-party governments

Now is the time to configure the international and domestic organizations

- Effective ITER Organization for system integration as well as site-locale procurements and assembly/integration/operations
- Effective US ITER Domestic Agency, focused on its deliverables, integrated with the ITER Organization, moving from R&D to fabrication, emphasizing accountability

FY06-08 activities

- Refinement of the roles, responsibilities and procedures for the IO and DA
- Completion of R&D and design, leading to issuing of the procurement packages
- Conducting manufacturing designs and prototypes, leading to start of fabrication
- Providing staff and cash to the ITER Organization